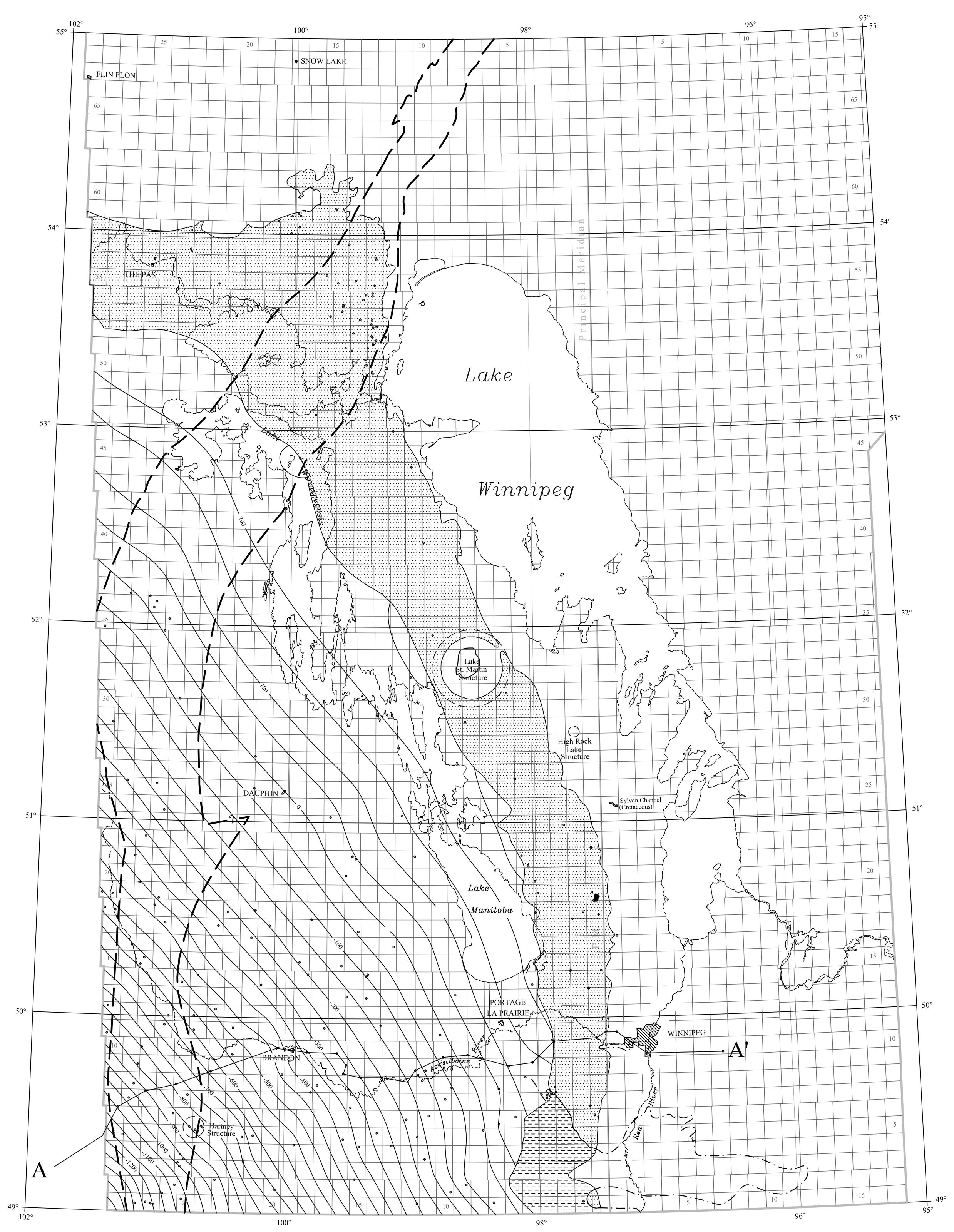
Manitoba
Energy and Mines
Geological Services Branch

GEOLOGY OF THE SILURIAN INTERLAKE GROUP IN MANITOBA

Stratigraphic Map Series S1-1

Structure Contour Map



0 25 50 75 100 km

1 : 2 000 000

INTERLAKE GROUP

Geological Framework

Detailed maps have not been compiled for subunits within the Silurian, because of correlation uncertainties. Available data suggest that the tectonic framework was relatively stable throughout Silurian time, with almost no evidence of basin differentiation in the Manitoba portion of the basin. This is evidenced also by the relative lithologic uniformity of the Silurian strata, which consist almost entirely of micritc to intraclastic and stromatolitic dolomites with scattered fossil-fragmental interbeds. These strata are generally representative of deposition under shallow-water, in part slightly restricted conditions, and have been interpreted by Roehl (1967) and others as intertidal to supratidal deposits. In the central part of the basin, the uppermost Silurian beds, stratigraphically above the beds comprising the Manitoba sequence, consist of dolomites with brecciated textures, desiccation cracks, fenestral fabrics, dolomite cements and erosion surfaces (=Upper Interlake). These features indicate periodic subaerial exposure and vadose diagenesis of carbonate deposited under marine or fresh water conditions (Roehl, 1967; Megathan, 1987; Haidl, 1987).

The relatively monotonous dolomite sequence is interrupted only by a number of thin sandy argillaceous marker beds that are believed to represent para-time-stratigraphic markers, minor depositional hiatuses that are very persistent and can be traced throughout most of the Williston Basin area (Porter and Fuller, 1959; King, 1964). The uniformity of Silurian lithology and the persistence of the marker beds attest to the tectonic stability during Silurian time.

One of the principal post-Paleozoic anomalies relates to the regional configuration of the pre-Jurassic erosion surface. If an east-west structural projection is drawn at the base of the Amaranth Evaporite (the lowest Mesozoic unit that approximates a time-stratigraphic marker), the structure is seen to be rather uniform as far east as the present erosional edge of the unit. However, when the elevations of known Jurassic outliers and embayments to the east (e.g. Lake St. Martin) are plotted, they are found to fall markedly below the regional projection, and indicate a pronounced structural flexure (perhaps even a structure reversal) at a point east of the main Mesozoic erosional edge. If these outliers are representative of regional Mesozoic structure, they indicate that the pre-Mesozoic erosion surface approximately paralleled present Paleozoic structure. Suprisingly, no evidence can be seen of any structural flexure in the Paleozoic sequence. Possibly the flexure is masked by the superimposed regional gradient, or possibly this represents a case of structural flexing and later reversal related to the Churchill Superior Boundary Zone.

If the suggested mechanism of differential uplift and subsidence related to the boundary zone is valid, and the pre-Mesozoic unconformity surface developed during a period of maximum uplift, the regional structural profile on the unconformity surface should be "normal" only for the tectonically positive setting. Later reversal or normalization of the tectonic framework would have caused a negative deflection of the erosion surface, which is what seems to be evidenced by the structurally low Mesozoic outliers.

Regional uplift followed deposition of the Interlake and perhaps younger rocks (similar to those preserved in the Hudson Bay Basin. Across the entire Williston Basin the Lower Paleozoic sequence was truncated by erosion associated with the sub-Devonian unconformity.

Stratigraphy

The relative uniformity of the Silurian succession, combined with a large area of no outcrop between the northern Grand Rapids area and the southern Fisher Branch area, have resulted in some miscorrelations and resultant problems in stratigraphic nomenclature. The present stratigraphic subdivision of the Silurian outcrop belt is that proposed by Stearn (1956), with slight modification. This detailed subdivision is applicable only to the Manitoba outcrop belt, and cannot satisfactorily be extended to the subsurface. Thus the correlation problems have little stratigraphic significance other than in the outcrop belt itself. The problem arises, however, that the Silurian faunal succession, as derived from the outcrop belt by Stearn, has incorporated some stratigraphic errors so that the faunal elements, in some instances, have been misplaced. A detailed corehole program initiated in 1980 was designed to clarify the correlation problems (McCabe, 1980a). These results indicate that the type "Inwood Formation" of the southern area is stratigraphically higher than reported by Stearn, and in fact, may be correlative with the Moose Lake/Atikameg formations of the northern area. Other so-called Inwood and Fisher Branch outcrops in the southern Interlake may also not be stratigraphically consistent. Due to these correlation problems, the term "Inwood" has been dropped (Lammers, 1988). Stearn (1956) also noted a number of faunal anomalies or inconsistencies in his paleontological studies, and preliminary indications are that most of these inconsistencies can be resolved by revision of the stratigraphic correlations.

In the Manitoba outcrop belt, the Interlake Group is subdivided into the following formations, in ascending stratigraphic sequence: the Fisher Branch, Moose Lake, Atikameg, East Arm and Cedar Lake formations. The top of the Lower Interlake falls below the top of the East Arm Formation in the Manitoba outcrop belt. The remainder of the Interlake in the subsurface is difficult to subdivide with confidence using geophysical logs.

The cross section illustrates the "layer cake" stratigraphy characteristics of most of the Lower Paleozoic sequence of the Williston Basin. The argillaceous marker beds that define the lithostratigraphic units on gamma-ray logs can be traced across the basin, but precision of correlation diminishes away form the central part of the basin where the depositional cycles are most complete. In the Interlake Group, three distinct marker beds are present, in ascending stratigraphic sequence: U_1-marker, U_2-marker, and v-marker.

Economics

The following wells indicate oil and gas shows in Manitoba: 5-20-1-27W1 (Robert Moore #1), 3-9-4-11W1 (Sweet Grass Pilot Mound #1), 16-33-4-13W1 (Dome *et al* Greenway), 16-33-5-24W1 (Calstan Hartney), 9-26-7-25W1 (Calstan Findlay), 16-18-18-29W1 (Imperial Madeline). Numerous crushed stone quarries utilizing the Interlake Group are present throughout the outcrop belt and are predominantly used for highway projects.

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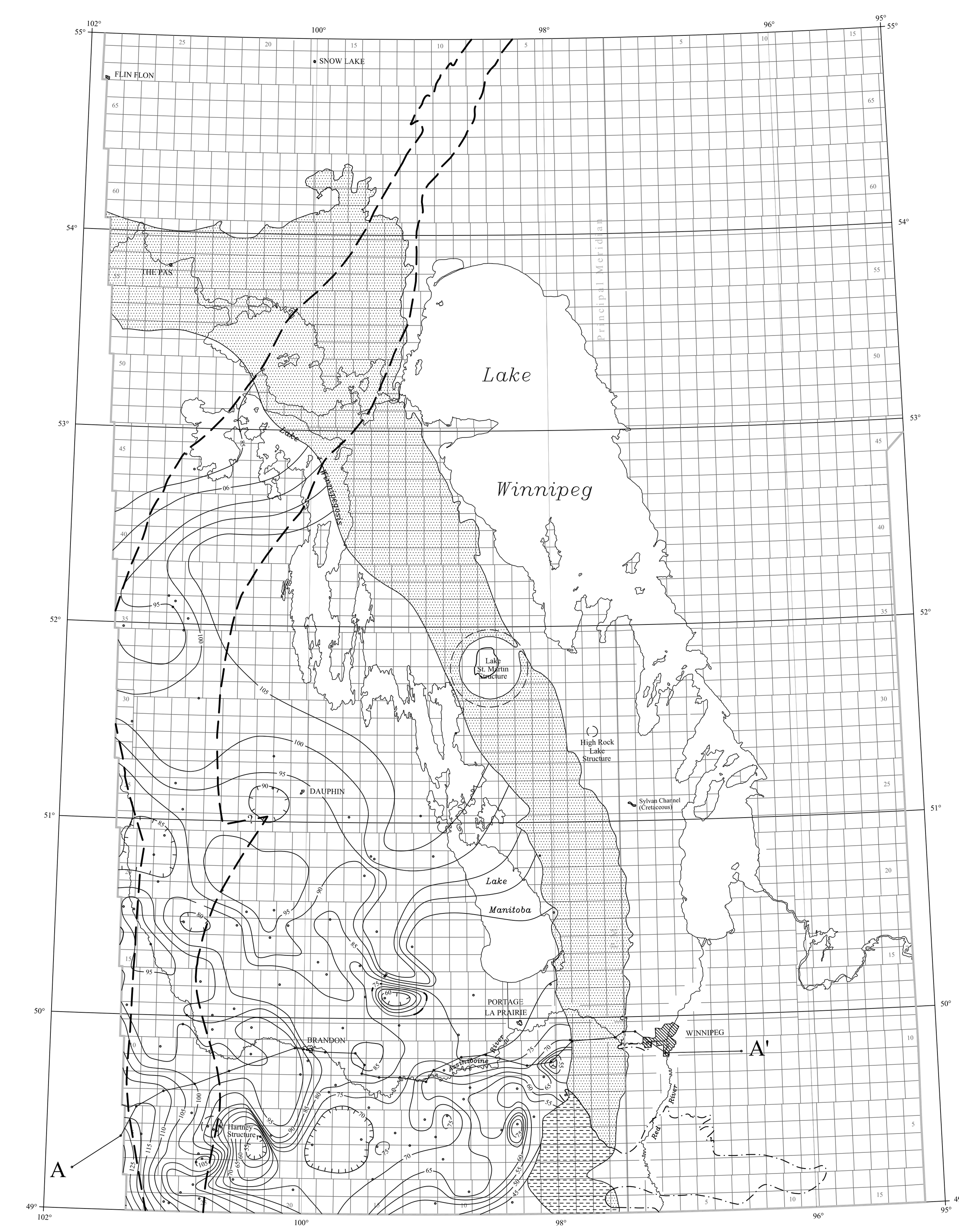
Isopach Map



0 25 50 75 100 km

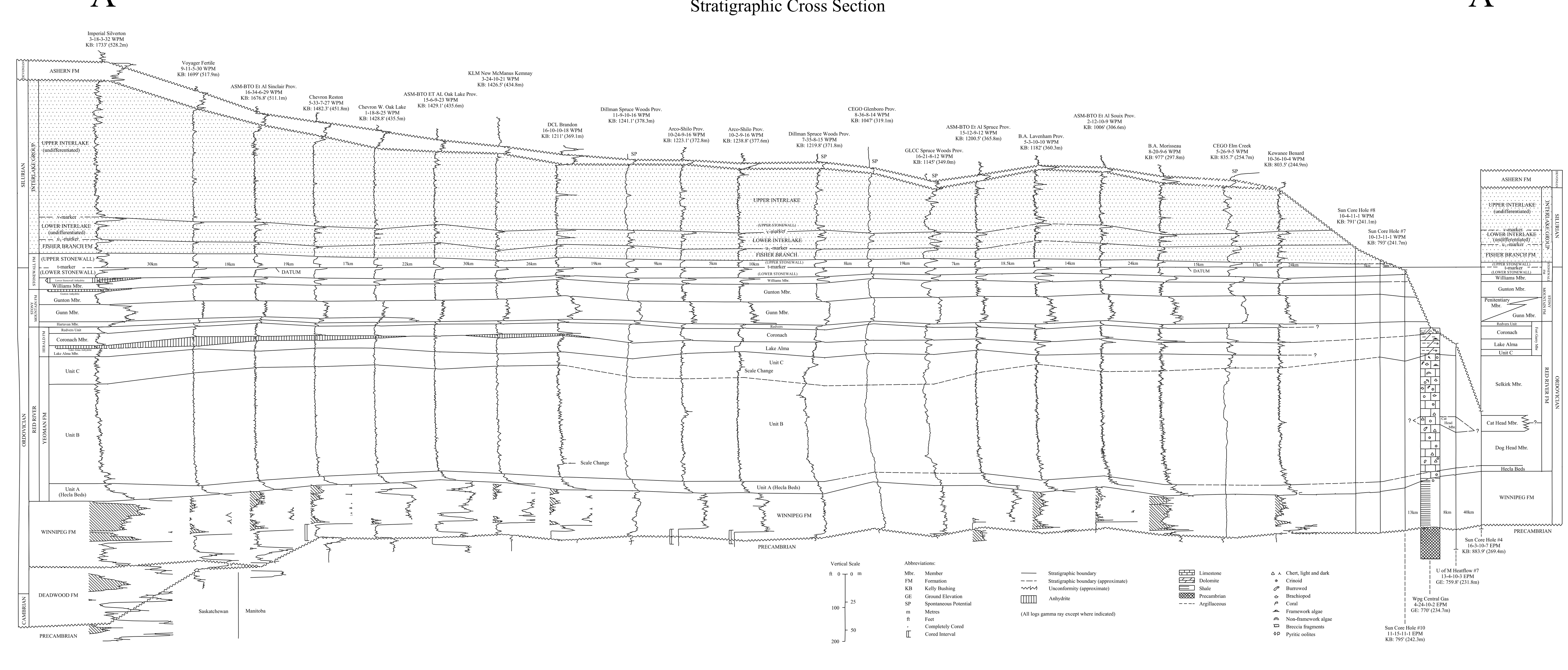
1 : 2 000 000

LEGEND (1 : 2 000 000 maps)

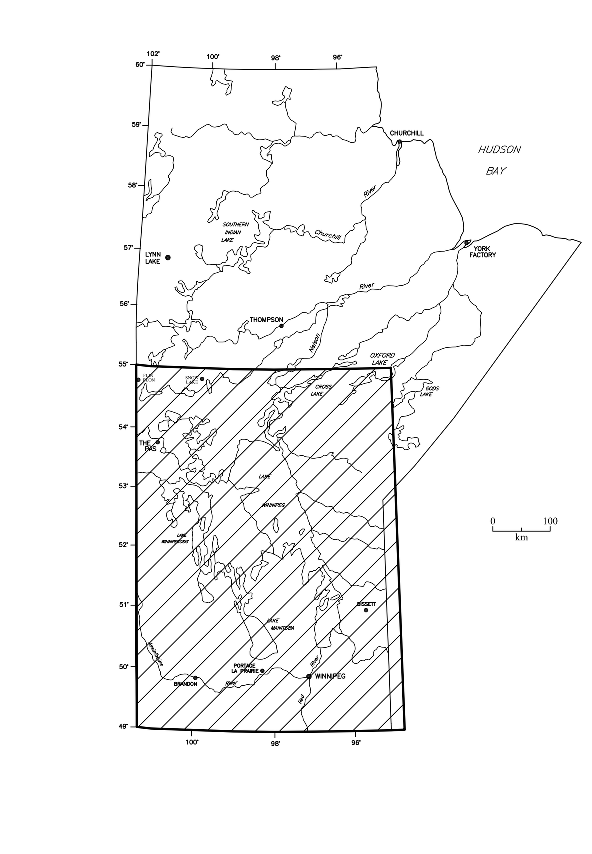
- Interlake outcrop belt
- Interlake subcrop belt
- Control well *
- Isopach Map contour interval (5 m)
- Structure Map contour interval (50 m) (sea-level datum)
- A A' Stratigraphic cross section
- Churchill Superior Boundary Zone

* Both confidential and non-confidential wells were used in the construction of these maps; only non-confidential wells are depicted.

Stratigraphic Cross Section



Location Map



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Cartography by: M.E. McFarlane

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